



Interview of Norman “Norm” Abramson

Interviewed by:
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James Pelkey: Originally, where did the need come from to connect these outer campuses, and how did you get to be responsible for this and how did you come to be prepared to deal with that issue?

Norm Abramson: Well, first I'd say a lot of people have the misconception that -- I suspect we may have contributed to this misconception that -- the prime purpose of the AlohaNet was to connect the outer campuses of the University of Hawaii, or in fact to really provide any operational facility at the university. Even today, about 15 years after the project, we occasionally get groups that come in from Japan who want to see the AlohaNet in operations, and I have to tell them that it really hasn't been in operation for over ten years. The original project had, as its goal, research more than operational needs of the university. I think it's possible that we may have justified the research, as researchers often do, by pointing to its possible applications for the University of Hawaii and for other areas that had difficulty with telephone communication of data, but certainly the goals of myself and the other people who were involved in the project were research goals rather than operational goals. I should say, though, that we did put up terminals on the other islands, never as part of operational networks but, in so far as the Aloha was not an operational network, but we had terminals as demonstrations on the big island south of Oahu and on Maui and throughout other locations on Oahu too.

Pelkey: So you had multiple locations so that you could demonstrate the viability of this mutually launching out the network and it working?

Abramson: Exactly, and that we could extend the range. We wanted to demonstrate that, that we could extend the range by repeaters, Aloha Repeaters.

Pelkey: How did you get involved in this? You were in the Computer Science Department?

Abramson: Nope. I was in the -- well, let's see, I guess I shouldn't say that. I have been an electrical engineer. I was trained as an EE and I taught EE at Stanford for six or seven years --

Pelkey: Prior to --

Abramson: Well, I spent one year after Stanford at Harvard, but I was really teaching EE there rather than computer science, and then I went to Hawaii.

Pelkey: What year was this?

Abramson: Twenty-two years ago, I believe. It was '65, '66, that's about right.

Pelkey: When did you get interested in this particular problem? How did it come to you?

Abramson: The way it came to us is that when I went to Hawaii, of course it was taking a pretty big gamble. Hawaii was and is no Stanford or Harvard, and at that same time, there are other competing advantages of working in Hawaii that are important to me, in spite of the fact that the intellectual stimulation at Stanford and Harvard are also important. There was very little research going on at the University of Hawaii, and I realized that we would have to start some kind of research project. At about the same time, within the first year after I was in Hawaii, the Department of Defense started -- or sold to Congress -- a fairly large research program -- this is 'large,' now, for the '66, '67, '68 time frame -- to, if I want to put it more bluntly than DOD did, to support developing universities. That is, it was research support of the project type specifically addressed to trying to bring universities such as the University of Hawaii into the first rank. We realized -- myself, Wes Peterson, Ned Weldon and others -- realized that this would be a good opportunity for us -- these are all people who went to Hawaii at about the same time -- to obtain the resources, the funding, that we needed for this kind of a research university. So we said: "Ok, what would be a good project for us?" Now, my background was communication theory, but I was just getting interested in computers. I, in fact, was teaching some stuff on computers at Harvard that year, the first time that was done in the general education program. Wes Peterson had done a lot of very creative work in related areas and Ned Weldon and so forth, and so we cast about for a research topic

that we thought would make sense to DOD, that we would be interested in, and came up with the fact that we were all communication theorists, we knew, we thought, a good deal about communications, that the telephone system, especially then in Hawaii, was inadequate for data. Hawaiian Telephone, at that time, was an independent company. It has since been acquired by GTE, but it had, I think it's fair to say, I think most people at Hawaiian Tel would agree, they had pretty poor service, sort of part way between North America and Europe in quality. You know how that is. So we put all this together, our interests and experience, capabilities in communications, the technology seemed to be going towards computers, and said: "Well, communications for computers makes sense." The telephone system appeared not to make sense at that time, especially in Hawaii, and we thought we had something which was intellectually stimulating and a package that we could sell to ARPA, and in fact, we did. That's how it all started.

Pelkey: Was it funded by ARPA from the very beginning?

Abramson: Let me think. Yes, it was funded initially by ARPA. What happened is that I recall going into ARPA, after I heard about the program, going to Washington –

Pelkey: Right, and who was -- was this the IPTO office you went to?

Abramson: Yes. Bob Taylor was the director of it at that point. You probably have run into his name.

Pelkey: I've talked to Bob.

Abramson: Larry Roberts was his deputy, and I recall a meeting -- this was one of the first meetings where I had come from the University of Hawaii, rather than from Stanford or from Harvard. I probably was a little touchy about that.

Pelkey: This would have been in '66?

Abramson: '66, '67, something like that. The program was called the THEMIS Program.

Pelkey: And this is the whole program of DOD to fund the universities.

Abramson: It was, I don't know, in the tens or maybe a hundred million dollars, or something of that sort, to provide university research support for second rank universities. I came in to talk to Bob. I don't know how I had been referred to him, some mutual friend in Washington, and Bob said: "Oh, yeah, we're building this great thing called the ARPANet." No nodes were up at that time, and I said: "Oh, what's that all about," and he went into some detail about it. I recall Bob was very blunt about 'what the hell is the University of Hawaii going to try to do on this?' I recall being –

Pelkey: A bit defensive.

Abramson: Not defensive, I would say offensive. Anyway, subsequently, Bob and I had some conversations about it, and Larry too, and I think we all got a pretty good laugh out of it after the fact, but I was pretty offensive at that time. I was probably more sensitive than I should have been. In any event, I recall some of the remarks he made and some of the remarks I made about the whole thing that weren't a very good way to start off any relationship. Never the less, we all seemed to rise above that, and I think that's a pretty good indication of Bob and Larry's capabilities, and they ended up providing a very large amount of money to the University of Hawaii, larger than the university had in any other project, to perform what we said we wanted to do. That's how Aloha started.

Pelkey: At that point, did you have the concept of using a radio network between the islands? Was that part of the funding project?

Abramson: The basic idea was radio communications. Now, that's the idea we started with. I don't think it's either the most important idea or the idea we finished with, because I think what happened is that

as we got the idea of starting radio as an alternative to telephones, we, not in any one blinding flash but over a period of two years, perhaps, realized that what was important about what we could do with radio was that it was a broadcast medium. We could do this multiple access thing that led to CSMACD, and that was what was important. In fact, I recall, in some meetings to justify the project when we were still more hung up than we should have been on radio, in discussions saying some to the effect: "Well, we don't have to be limited to one channel per user. We could do some more efficient things with radio." We still didn't have the full idea of what we were going to do, and I know that Bob and Larry both took up on that and said: "What?" and I had to admit I didn't know exactly what, but I said: "Something much more sensible for radio can be done here than assigning a single channel for every user in the network. That's crazy. That won't work."

Pelkey: Were they sharing with you the kinds of ideas that were happening in the ARPANet so that you were aware of their developing paradigm of passing data that has this bursty nature, and that you wanted to do something more than set up a channel in that domain? Just like in your world, it was better than having a frequency assigned for every user? There were similar sorts of conceptual problems.

Abramson: That's right. They were certainly open in telling me all of the ideas that they had. I was as open as I could be in trying to understand them, and vice versa. So yeah, they were providing those ideas. I don't know at what point anybody realized that there was a commonality of ideas there. It's hard to say, but again, it didn't come, at least to me, in any blinding flash.

Pelkey: Do you remember a moment or incident or a meeting, whatever, when this broadcast nature became obvious or that you became aware of the fact that you had found something connected to this broadcast nature?

Abramson: I recall a meeting at the University of Hawaii, without Larry or Bob -- and Bob was leaving the organization at that point -- but I recall a meeting where precisely this point was discussed. We said: "Look, we can't assign one channel per user. We want to think about -- although we may never build it -- we want to think about a system with hundreds of users, something practical for that. You can't have hundreds of channels. Now what can you do for that situation?" I and others were aware of the spread spectrum and multiple access through spread spectrum at that point, and the idea of simply transmitting the data in bursts was sort of a natural one. I don't know how, it just sort of came out, and once that had been suggested, it seemed awfully attractive. We mulled it over for a while, and I recall thinking about should we do this or should we do other things, and very quickly we said: "Gee, that's going to be easy to implement. It looks like it's going to work out well." We had no theory at that point, and I recall, at the end of a meeting, saying: "Ok, let's go in this direction." I recall a meeting at which we made that decision.

Pelkey: Was there a sense of either frustration before this meeting about what you were going to do or how you were going to solve the problem, or had the process of how you were going to implement followed fairly quickly after the funding and you had just been workman-like about it, leading to this idea coming up? Had there been a period of struggling with how to do it?

Abramson: I don't recall a struggle period for the system design or for the basic theory. I don't recall any of that. I think that was pretty nice. Things fell into place very -- it was a good idea, it was a simple design, and I think Bob Metcalfe had made the same point. There's a lot to be said for simplicity other than just the fact that you can build it and maintain it more easily. There's a lot for conceptual simplicity, because it leads to other things. It puts you in command of the ideas, and that's important. So I don't really think we had any difficult times like that unless you want to consider the details of the implementation. I know the engineers I hired were bright guys, and they had very sleepless nights, some sleepless nights I'm sure, but I was insulated from that because I didn't know enough about it.

Pelkey: Why didn't somebody else come up with this notion and implement it in practice before your group?

Abramson: Maybe the time wasn't right, I'm not sure. Think about it; what were the areas where you could apply it? In fact, it took a while for us to apply it. One of the reasons was certainly that -- my impression, and I think this was common in a lot of people, was that to do something different with radio communications means that sooner or later, you're going to have to fight the FCC, and I didn't want to do that. I was faculty, a professor, and I truly felt I had no capability in that kind of area and I wouldn't do very well at it, so I really couldn't see myself as trying to shake up the FCC and have them change their rules. That meant that I was thinking of operating under the existing rules, and Aloha wouldn't allow you to operate under existing rules. As a research project, it was quite interesting, but to look further to operational and commercial systems --

Pelkey: That was a horse of a different color.

Abramson: Yeah, quite a bit. I suppose if I had not been in a university I might have given that some thought.

Pelkey: When the network first worked and you had multiple terminals talking to some central host, was that a particularly big event to the group of you that had been working on this?

Abramson: Oh, yeah. We had a big party at my house, and I -- in fact, I recall wording the invitation on that to something to the effect that we're marking the success of the first phase of the Aloha project, and everybody went: "Ok, now what's the second phase?"

Pelkey: Let's enjoy the first one before we go on to the second. Do you recall when that was?

Abramson: I could give it to you. I would say -- there was a paper that I wrote. Let's see, that was --

Pelkey: 1970, I believe.

Abramson: -- 1970, that first paper, ok. Then, it was about six months before I gave that paper. Wait a minute, let me think now.

Pelkey: The paper was published in '70, therefore it must have been submitted probably in '69.

Abramson: That was at a conference. There was a paper that I gave at a conference, and I think the conference was in '70. I can get that date for you.

Pelkey: Would you?

Abramson: Do you have a copy of that paper I sent you? It's in there.

Pelkey: No, I did not bring that with me.

Abramson: I can find out, no problem, and I can date --

Pelkey: And if it's referenced in that paper, I can find it as well, then.

Abramson: I think it is referenced in that paper, but if it isn't, I'm sure I have some data in my files and I can give you exact dates.

Pelkey: That would be helpful, the first time you demonstrated. So then you gave a paper, and the paper was presented where?

Abramson: At an IEEE conference, I believe it was in Georgia, Atlanta, I'm not sure. I'll have to check that out too. I recall that it was one of the first conferences that I went to from Hawaii to the east coast,

and I recall trying to get up early in the morning and saying: "Oh, my God, the six hour time difference is a killer." I got used to it after that. It was an early one.

Pelkey: Do you remember whereabouts in Georgia it was?

Abramson: I can look that up.

Pelkey: Dave Farber was there –

Abramson: I believe he was.

Pelkey: -- and he heard a paper that was presented by John Newall and Dave Farmer that spurred his -- because he was looking for a project to work on, and that paper was seminal in terms of his thinking, causing him to think about doing a ring network. It was the same IEEE meeting.

Abramson: Where was that in Georgia?

Pelkey: He just remembered that –

Abramson: That's my recollection too.

Pelkey: Some mountain there somewhere.

Abramson: Sounds right, but I can find out, because the paper will give me that information.

Pelkey: So you presented at this meeting.

Abramson: It was a long time ago.

Pelkey: Yeah, it was a long time ago. So that was kind of the coming out, in terms of telling other people, although presumably Larry Roberts knew what was happening.

Abramson: There was not particular -- we were not trying to keep it a secret. It was a university thing rather than industrial, so we weren't trying to keep it a secret. It's just that nobody was looking for an awful lot of research to come out of Hawaii at that point.

Pelkey: What was the reception to the paper?

Abramson: Well, things don't get received with 'oh yeah, that's the way to go' sort of reactions ever. I just have never seen that happen, no matter what the ideas are. Good ideas get accepted and recognized and appreciated by a process of accretion, I think. Somebody looks at it and says: "Gee, that's pretty good, but if I did this to it," and other people change it a little bit, and sooner or later it starts affecting the way people think about certain kinds of ideas, and I think that's what Aloha was able to achieve. It made people -- or let people -- think in terms of broadcast architecture, and that was a big setting free from the telephone company.

Pelkey: Now, in talking to Bob, he tells me the story of Steve Crocker's apartment. You probably have heard him tell the story.

Abramson: Go ahead, I'm not sure.

Pelkey: After a long conversation that evening, he retired to the sofa and, wanting to read something, reached over and picked up what turned out to be these proceedings with your paper in it. He started reading your paper and he was infuriated with this notion that people just sit there and type, and he said: "People don't do that. If people don't get response, they stop typing," and that would significantly change

the nature of how the network worked, as opposed to people just sitting there and typing. He came to that prepared because his PhD dissertation had just been rejected, and he was looking for some math to beef up his PhD thesis that was on the ARPANet, and then he went to Xerox. When did the two of you first come in contact?

Abramson: I'm not sure how it happened, but what happened is that Bob came to Hawaii for the Aloha project. Now, I don't know -- in fact I think I looked this up when I wrote my paper -- we somehow ended up paying some trivial amount, maybe it was expenses or something. The project, at that point, was probably near its peak. That is, we had, I would say, about 40 people or so, and either because I'm not a good manager or because that's the way I manage, but whatever it is, I tend not to try to keep in touch with everything that's going on in the project. I did at that point, the Reagan form of management. It has its good and bad points. Now, Bob was introduced to me through Dick Binder. Have you run across his name?

Pelkey: No.

Abramson: Dick was a graduate student on the project, but he was somewhat older than the typical graduate student. He had some industrial experience, and Dick eventually became the person responsible for the protocols -- what are now called protocols; at that point, we thought of it as software and programs -- and the software structure of the network. I don't know how, but somehow he got in touch with Bob Metcalfe, and then I found out that Bob Metcalfe, who I just knew as some graduate student from, I think it was MIT or Harvard at that point, was coming out and wanted to work on the network, Dick Binder wanted to work with him, and that he had done some interesting things, and I said: "Great," but I didn't make that decision, I don't think. Bob came out and he was working more or less independently, but with Dick, I think. He certainly wasn't working very closely with me in research, although we had a number of conversations, and I took a look at his thesis and I was quite impressed.

Pelkey: Before or after it was published?

Abramson: I don't recall. It was when he was out in Hawaii sometime. I got a copy of what he had written and I read that, and I made it a point to talk to him because I recognized that -- I thought this was some good stuff, and he had some very nice ideas about our network that I hadn't really thought out myself before. That's basically what happened in Bob's case. He was out --

Pelkey: This would have been in '72?

Abramson: Yeah, I think it was around then.

Pelkey: Was he at the university for some time?

Abramson: My recollection is that he was there for about six months, but Bob would know best. What did he say?

Pelkey: He was my first interview, so I --

Abramson: I think he was there -- I'll give a guess -- for about six months. I know it was time enough for me to talk to him on a few occasions. We went out to dinner a couple of times, that kind of interaction, and he was rather closed-mouthed about what he was doing with respect to EtherNet, and I didn't want to push him on that.

Pelkey: Do you recall, was he at Xerox?

Abramson: I talked to Bob, I think, about a year ago. In fact, I asked him specifically that, because I wanted to clarify exactly what was happening -- what had happened. According to Bob, and I think this was the case, as soon as he finished his thesis he was hired by Xerox, and then, of all things, he got

Xerox right away to send him to spend six months in Hawaii. I recall a remark I made to Bob at that time, about a year ago, I said: "Well, that shows that you were a hell of a salesman even in those days."

Pelkey: That's exactly right.

Abramson: Can you image getting a company to hire you and then saying: "Ok, go spend six months in Honolulu."

Pelkey: I'll have to ask him about that. He and I talk frequently, so I'll ask him about that.

Abramson: That's what I remember him saying at that lunch we had.

Pelkey: So then Bob's PhD dissertation as MAC Report 114, then what you were doing in your group had a significant impact upon his thinking, in terms of –

Abramson: Well, it was analyzed in his thesis, to a much greater extent than we had analyzed it. He had done some things that we had not thought of, and of course, the whole question of putting it on a cable is something we had never thought of.

Pelkey: And this issue about the back-off algorithms is kind of a -- where he brought that to the equation, saying: "If there is collisions and people know there are collisions, what should the behavior be?" IE, there should be this back-off.

Abramson: Really, what Bob showed, and this was graduate student-itis -- I've seen this many times -- is that it doesn't make a damn bit of difference. I think that Bob would say that he agrees, but it does give you a PhD thesis, but it doesn't make a damn bit of difference, and you show it thematically, which I guess is one of the things that was a problem on his first version of the thesis.

Pelkey: You made a note in your paper that Larry Roberts was more -- although when you first had the project approved, it was really Bob Taylor and Larry Roberts was a program manager primarily responsible for the ARPANet, but shortly thereafter Larry succeeded Bob as director –

Abramson: It was more than that. When I first met both Larry and Bob in Washington that day, Bob was the Director of IPTO, I believe, and Larry was deputy, so he was naturally in line for the position. Furthermore, I believe it was known then that Bob was leaving and Larry would be taking over, so Larry was really moving into that.

Pelkey: So Larry became the funding agent. He was the person who said: "Yes, we're going to give money to this project." Your contact with Larry, the way you describe it, was unique in the sense that it was more than just money. He personally took an interest in your project and got involved in the project at some level.

Abramson: More than just took an interest and got involved, he did research. If he had been a doctoral candidate, he would have gotten a PhD for what he did. He doesn't need another one. If he had been faculty, he would have published three or four papers for what he did. He was an active, innovative, imaginative contributor to the whole project all the way through.

Pelkey: With him being in Washington?

Abramson: With him being in Washington, yeah.

Pelkey: How did he communicate back and forth so that he could be that actively involved?

Abramson: Through various things. For example, I recall going into his office in Washington once and he said: "Hey, Norm, I think we can double the throughput of an Aloha channel by this clever idea I have

of 'slotting' I don't know if he called it slotting, but I think he did, he called it 'slotting.' I don't know how (unintelligible) you got into, but anyway it's a theoretical result which Larry came up on –

Pelkey: By slotting you mean –

Abramson: Putting time -- setting the packets so that they're synchronized in time to some fixed time base. That turns out to give you a theoretical increase of a factor of two in the capacity, but has some other problems. It was an interesting theoretical problem.

Pelkey: It was a little more expensive to implement?

Abramson: Not much, but a little bit. The main thing is that it has some operational disadvantages, but it's a good idea. It's used in several places now. He came up with the right answer, theoretically, of how the slotting would affect the capacity, and he went through a proof which I found very difficult to follow, and I recall looking at it, being convinced, but I couldn't follow his proof, and I went back and proved it another way, and that was one occasion. Another occasion -- I think it was at a meeting that he and Steve Luchesik, who is now the chief scientist of Northrup and was head of ARPA at that point, came out to Hawaii, and he proposed something called 'Capture Effect.' Actually, it was something known before in other contexts, but he said: "If you use this something called 'capture effect,' again you can increase the throughput of the channel, and you can get these results." I recall thinking about it, going away and coming back to him later and saying: "Oh yeah, you get these results. You get these other results, too." So neither Larry nor I is the kind of person who writes long detailed proofs and revels in the mathematics of it. I think we both are the kind of researchers who like to think about ideas and hopefully prove something or other, but not to get –

Pelkey: Totally rigorous.

Abramson: Well, not so much rigorous as that there's a place for mathematics and there's a place for ideas and common sense, and I think we like to work at the boundary of those, whatever it is. We worked that way on a lot of those thought.

Pelkey: It must have been a fun interaction.

Abramson: It was a lot of fun. It was very stimulating.

Pelkey: To have someone in that capacity who was coming to you and introducing ideas, it must have been –

Abramson: Yeah. That's really the way a good university should operate.

Pelkey: You were at the University of Hawaii and you were doing this project. You weren't at Stanford or Harvard or MIT, and to have someone like Larry who was coming in and turning up the heat every once in a while, or introducing some new ideas, must have been for you, professionally, rewarding.

Abramson: Yes, it was, and we appreciated that an awful lot. We appreciated the funding too, because none of it would have gone on without the funding.

Pelkey: That story you have in your paper about going to the blackboard in his office one day, is that a true story?

Abramson: Yes, absolutely.

Pelkey: That's incredible.

Abramson: You've got to remember, this is DOD.

Pelkey: Then, for you to come back in and not talk about it, and then leave and never say anything, then all of a sudden get a phone call two weeks before December 17 saying: "Get your site prepared." What happened when you received that phone call?

Abramson: I don't know. I think I sort of half expected to get that phone call.

Pelkey: Did you really?

Abramson: I knew the way DOD worked.

Pelkey: That story will be in the book, for sure, because it's just so fantastic.

Abramson: No, that's absolutely true. He was called out and I was just sort of waiting around reading things, and I saw this stuff on the board -- great way to put it on the agenda.

Pelkey: Just to have the chutzpa to go up to the board and put yourself in --

Abramson: Well, Larry was the sort of guy who you could do that with and not worry, and we had that rather easy way of working together so it wasn't a problem. My suspicion is that he knew I had done that, because it was in my handwriting. It just stood out, and he said: "Well, that's a pretty good date. Do it."

Pelkey: A lot of people visited -- first of all, by this time, ARPANet is, in your community, it's well understood what was happening and that it was working, but the AlohaNet was also working.

Abramson: Yeah, but of course, AlohaNet was located in Hawaii and for the islands, whereas ARPANet was getting --

Pelkey: Different scale and so on, but in terms of their coming to fruition as research projects, they came to fruition about the same time --

Abramson: I think ARPANet preceded us. I'm not too sure about that. I think if you want to say which one went into operation first, I think it was the ARPANet, but I'm not sure.

Pelkey: Yeah, probably. It depends on what you call 'operational,' but probably. So the ideas of all these things were there. It must have been a very exciting period of time, with what you were doing and what was happening with the ARPANet. There was a new form of communications work for computing devices, and something new was happening, as opposed to these telephone circuits that were out there.

Abramson: Absolutely. It was a lot of fun. There aren't too many times when you have the opportunity to get into the outfit that really -- the birth of an industry like that.

Pelkey: Did the group of you have a sense that you were giving birth to something?

Abramson: It's one of these things, again, where it sort of dribbled into your consciousness, Jim. Not at the beginning, no, but as things went on and you saw what happened, as EtherNet came on and ARPANet went on line and the FCC started looking at frequencies to use for these kinds of things, it all sort of sorted itself out.

Pelkey: Was the Carterphone decision of the FCC something that you were aware of or talked about?

Abramson: I was aware of it, yeah. I don't think we talked about it. We were really more theoreticians at that point.

Pelkey: But given that you had this monolithic network, and all of a sudden realizing that people were finding ways to be allowed to connect other things to it --

Abramson: Well, I'll tell you what impressed me. I don't know about other people, but what impressed me quite a bit was the fact that Larry was able to go through the established procedures, that is he was able to buy lines from AT&T, to use them in new ways, in spite of, I think at that time, some pretty hot opposition on the part of AT&T, saying: "This packet stuff won't ever fly. That's not the way you communicate. You communicate this way." Larry was able to communicate another way, and do it on a large scale, and do it in such a way that he moved AT&T. Now that's an achievement. Moving AT&T is not easy to do.

Pelkey: I don't have any other questions about that period of time. Is there something that I haven't asked you?

Abramson: Nothing that I can think of. It was a lot of fun. It was good research, and a nice bunch of guys.

Pelkey: Is there more on the map?

Abramson: Yeah, I hope so.

Pelkey: Do I understand correctly that two of your students were Charles Bass and John Davidson?

Abramson: Charles Bass was never, Charley was. He was Charley then and he's Charley now. They were graduate students in the Aloha project, yes. Bob was not. He was, I'm not sure, a post-doctoral student. He showed up. He was just a good guy to have around that thing. We never worried too much about who was in what title. Now, as far as John and Charley are concerned, they were both grad students.

Pelkey: The University of California, Berkeley.

Abramson: They -- I'm not sure where they came from. Was it Berkeley? They were undergraduates there?

Pelkey: I think so, but I'm not sure.

Abramson: They came to the university; I recall them in classes, I talked to both of them quite a bit. They both were interested more in the software than the mathematics and so forth. They ended up working directly for Wes Peterson, both of them.

Pelkey: Were they involved in the project right from the very beginning?

Abramson: Yes, but they were involved, I would say, not at the heart of the project. They were involved, in that they were paid by the project, but they were doing coding for a timesharing system that was built by Wes Peterson with an IBM computer. For some reason, both of those guys -- I don't usually interact that much with the software types, but I did talk to both quite a bit, and I was on their thesis committee, but Wes Peterson was the chairman of the committee. So, yeah, they were both Aloha graduates.

Pelkey: Were there other Aloha graduates who went on in the data communications industry?

Abramson: Certainly there were, because we had, at the height, maybe 25 people -- 25, perhaps, graduate students.

Pelkey: Was there anyone like Charlie Bass and John Davidson?

Abramson: It's hard to find people of that caliber. I don't want to slight anybody, but I can't recall anybody else that I would name right off the bat. There are lots of good people who were doing some nice research these days, but certainly Charlie and John both stand out.

Pelkey: So in 1970 you gave the paper in Georgia, and there was a succession of papers that followed that, in terms of getting the message out about what you had accomplished. Then, this research project stayed in existence for some period of time. I assume there was continuing refinements and graduate students worked on it and so on, but after a period of time you moved on to other things.

Abramson: Well, basically what happened is that we became uncomfortable under the ARPA umbrella after a while, but we had some problems –

Pelkey: Because Bob came in and started getting involved in things after '72, and he had his packet radio that he was trying to do which was a different topology, systems design, than yours.

Abramson: Perhaps. There were some decisions in system design that Bob made which were political rather than technical. He was more concerned with -- he was concerned with trying to sell this to other people at ARPA and DOD.

Pelkey: His network design was many people in the field being able to talk to each other.

Abramson: That's ok, that's what we were doing too. No problem there. You mean directly to each other instead of through a central point? Oh, ok.

Pelkey: So therefore this kind of multi-access methodology would not have worked -- the way he characterized the problem –

Abramson: There wasn't that much difference. We were interested in that too. That problem is still an open problem in many respects. We were interested in that. We had problems with Bob and DOD, primarily, because there were some hard-liners in DOD at that point. It's hard to imagine now, but we had problems with graduate students from foreign countries, and one guy in particular from Canada –

Pelkey: In terms of not wanting to do DOD work?

Abramson: No, in terms of DOD saying: "We don't want to -- "

Pelkey: Want to fund their education.

Abramson: Well, I recall sitting in an office with Bob and a Colonel, who shall remain nameless, and talking about our Canadian researcher, and the Colonel looked at me and said: "Well, that makes me uncomfortable," and there was no ambiguity on anybody's part that this was simply not going to fly, and that was his way of saying it. We just felt it was better to terminate the project at that point, and I think it was the right time to terminate it from lots of points of view.

Pelkey: So the work that Bob did, in terms of packet radio, which had an impact in terms of internetworking and the creation of TCP from the NCP and so on, the work that had been done at the University of Hawaii, what they did built on what you had done, but it took on a different . . .

Tape Side Ends

Pelkey: So it was clear that this process was done for you and the University of Hawaii, and you went on to other things. Were they involved in data communications?

Abramson: Oh, yeah. I don't know about the University of Hawaii. I did. I went on to some things in the international area and ended up doing some work with the United Nations, and got involved in a whole bunch of other things, so yeah. Now, the Aloha project sort of -- the brand name is worth a lot, so we've kept that. We have a number of industrial sponsors who provide us with a small amount of funding, and we use Aloha to get that kind of funding.

Pelkey: I unfortunately have to catch an airplane. This has been very helpful and very enjoyable as well. I greatly appreciate your time.

Abramson: I hope it was helpful in getting things right. It looks like it's going to be an interesting book, though, whether it's right or not.

END OF INTERVIEW